Measles

REPORT IMMEDIATELY

Section 1: ABOUT THE DISEASE

A. Etiologic Agent

Measles is caused by the measles virus (genus *Morbillivirus*, family *Paramyxoviridae*).

B. Clinical Description

Measles is an acute disease characterized by fever, cough, runny nose, conjunctivitis, erythematous maculopapular rash, and characteristic mouth lesions (Koplik spots).

The prodrome, which lasts 2–4 days (range 1–7 days), is characterized by a fever that increases in stepwise fashion, often peaking as high as 103–105°F. This is followed by the onset of cough, runny nose, and/or conjunctivitis. Koplik's spots, a rash (enanthem) present on mucous membranes, is considered to be definitive for measles in the presence of other signs and symptoms. It occurs 1–2 days before the rash to 1–2 days after the rash, and appears as small blue-white spots on the bright red background of the buccal mucosa. The measles rash is a maculopapular eruption that usually lasts 5–6 days. Classically, it begins at the hairline, then involves the face and upper neck. During the next three days, the rash gradually proceeds downward, reaching the hands and feet. The maculopapular lesions are generally discrete, but may become confluent, particularly on the upper body. Initially, lesions blanch with pressure. Fine, scaly desquamation may occur over more severely involved areas. The rash fades in the same order that it appears, from head to the extremities. Other symptoms of measles include loss of appetite, diarrhea (especially in infants), and generalized lymphadenopathy.

Complications of measles include otitis media, pneumonia, laryngotracheobronchitis (croup), encephalitis (approximately 5–10 per 10,000 reported cases), seizures with or without fever (6–7 per 1000 reported cases), and death (approximately 1–3 per 1,000 reported cases, mostly from pneumonia and occasionally from encephalitis). The risk of death from complications of measles is higher in younger children, older adults, and individuals with immunosuppression. The most common cause of death is pneumonia in children and encephalitis in adults. Pneumonia complicates 6% of measles cases in the U.S., and 19% of measles cases are hospitalized.

Measles in an immunocompromised person may be severe, with a prolonged course, particularly in those with T-cell deficiencies (certain leukemias, lymphomas, and HIV/AIDS). It may occur without the typical rash, and the patient may shed the virus for several weeks after the acute illness.

Measles during pregnancy results in a higher risk of premature labor, spontaneous abortion, and low-birth-weight infants. Birth defects (with no definable pattern of malformation) have been reported rarely, without confirmation that measles was the cause.

C. Vectors and Reservoirs

Humans are the only host for measles.

D. Modes of Transmission

Measles is transmitted from person to person by droplet or direct contact with nasopharyngeal secretions of an infected person and by the airborne route.

E. Incubation Period

The incubation period of measles, from exposure to prodrome, averages 10–12 days. From exposure to rash onset, it averages 14 days (range is 7–18 days).

F. Period of Communicability or Infectious Period

The infectious period is from four days before to four days after rash onset (counting the day of rash onset as day zero). Immunocompromised patients may have prolonged excretion of virus in their secretions and can be infectious for the duration of their illness. Measles is highly infectious, with up to 5,000 infectious particles excreted per hour. Infectious particles may remain suspended in air for hours, depending on ventilation, sunlight exposure, and relative humidity. Asymptomatic carriage has not been documented.

G. Epidemiology

Measles occurs worldwide. In the temperate zones, peak incidence is in late winter and early spring. One dose of Measles, Mumps, Rubella (MMR) vaccine induces measles immunity in about 95% of vaccinees; however, due to measles' extreme infectiousness, 2 doses are necessary to prevent outbreaks in the 5% that remain susceptible after 1 dose of vaccine. Vaccine failure after 2 doses, both administered at $\geq$12 months of age, is uncommon.

Measles is the leading vaccine-preventable killer of children worldwide. In developing countries, case-fatality rates average 3–5%, but can range as high as 10–30% in some localities. Since 1997, incidence of measles in the U.S. has been very low, with fewer than 200 cases reported each year. A record low annual total of 44 cases was reported in 2002. Indigenous transmission has been interrupted and an increasing proportion of U.S. cases are imported, often from Europe and Asia, and they occur among U.S. citizens traveling abroad, persons visiting the U.S., and adoptees from other countries. (Cases are considered imported from another country if the rash occurs within 18 days of entering the U.S. and the illness cannot be linked to local transmission.) Due to an aggressive measles vaccination program by the Pan American Health Organization, measles incidence is now very low in Latin America and the Caribbean. Measles elimination from the Americas appears to be an achievable goal.

All individuals may be at risk for measles, but those most at risk are generally limited to five groups:

1. Children <12 months of age (those who are too young to be immunized);
2. Unimmunized individuals;
3. Adults who may have received an earlier ineffective measles vaccine prior to 1968 or who are unimmunized because they graduated from school prior to mandatory measles vaccination;
4. Children and adults with only one dose of measles-containing vaccine; and
5. Those who are foreign born and have never been vaccinated or did not have measles as a child in their country of origin.

Adults born in the U.S. prior to 1957 are generally considered immune. (The exception to this is in health care settings, where year of birth does not constitute acceptable proof of immunity.)

H. Bioterrorist Potential

This pathogen is not considered to be of risk for use in bioterrorism.

Section 2: REPORTING CRITERIA AND LABORATORY TESTING

A. What to Report to the Massachusetts Department of Public Health (MDPH)

Report any of the following:

- A case of rash illness accompanied by fever;
- A suspect case of measles (with or without fever), as diagnosed by a health care provider;
- Positive serologic test for measles immunoglobulin M (IgM);
- Significant rise between acute- and convalescent-phase titers in serum measles immunoglobulin G (IgG), or total antibody level by any standard serologic assay; or
- Isolation of measles virus from a clinical specimen.

Note: See Section 3C for information on how to report a case.

B. Laboratory Testing Services Available

Serologic Testing

Measles IgM Antibody Test

It is extremely important to obtain laboratory confirmation for cases of measles and suspect cases of measles. Due to cross-reacting antibodies and other problems, there are issues relating to the sensitivity and specificity of commercially available IgM antibody tests. The MDPH strongly recommends submission of specimens to the MDPH State Laboratory Institute (SLI). Ideally, the specimen should be drawn at least three days after onset of rash to minimize the possibility of negative results because of insufficient time for the development of measurable antibody. If serum is collected prior to the third day, a follow-up specimen may be requested. The amount of serum required is at least 2 mL.

Measles IgG Antibody Paired-titer Test

Paired testing for IgG antibody can be helpful when measles IgM antibody results are not interpretable. An acute serum should be collected as soon as possible after onset of rash; convalescent serum should be collected about 14 days later. Measles IgG antibody testing is performed at the SLI under special circumstances and after consultation with a MDPH immunization epidemiologist. The amount of serum required is at least 2 mL.

Shipment of Sera

Please refer to *Attachment A: Specimen Collection for Diagnosis of Measles* (at the end of this chapter) for instructions on collecting and submitting specimens to the SLI.

Sera should be sent on a cold pack with a completed SLI *Specimen Submission Form* (found at the end of this chapter and on the MDPH website at www.mass.gov/dph/bls/generalform.pdf) to:

Virus Isolation Laboratory
MDPH State Laboratory Institute (SLI)
305 South Street
Jamaica Plain, MA 02130

Before sending sera, please call a MDPH immunization epidemiologist at (617) 983-6800 or (888) 658-2850.

Virus Isolation/Molecular Characterization of Measles

Virus isolation and detection by reverse transcription polymerase chain reaction () in clinical specimens is less useful for disease control purposes than serologic testing because results may not be available for several weeks. However, molecular characterization of measles virus obtained from viral culture is an extremely important tool in epidemiologic investigation. For example, it can help determine source of the infection and which cases and outbreaks are linked to each other. Molecular epidemiologic surveillance helps: 1) determine the origin of the virus; 2) determine which viral strains are circulating in the U.S. and whether these viral strains have become endemic; and 3) in cases where serology is not useful or possible (for example, when a suspect case has been recently vaccinated with MMR), confirm the case using virus isolation and distinguish between wild-type virus and vaccine virus using molecular characterization.

The SLI Virus Isolation Laboratory performs measles virus isolation. It will also forward all measles isolates and any original specimens collected from IgM-positive patients to the Centers for Disease Control and Prevention (CDC) for further characterization.

The table below and *Attachment A: Specimen Collection for Diagnosis of Measles* (at the end of this chapter) show how to collect specimens.

Measles Viral Isolation

Specimen	Collection Interval
Urine[1]	≤5 days after rash onset (but up to 16 days)[2]
Nasal aspirate or nasopharyngeal swab[3]	≤5 days after rash onset

1 Clean voided first morning urine (50–100 mL).

2 Samples collected after five days after rash onset have much lower chances for successful isolation of virus.

3 Separate swab for nares and pharynx.

A MDPH immunization epidemiologist must be contacted (24 hours a day, 7 days a week) at (617) 983-6800 or (888) 685-2850 to arrange for the submission of clinical specimens for viral isolation, if needed. See *Attachment A: Specimen Collection for Diagnosis of Measles* (at the end of this chapter) for the current protocol for collection and submission.

When submitting clinical specimens to the SLI, you must use the SLI *Specimen Submission Form*, which can be found at the end of this chapter and on the MDPH website at www.mass.gov/dph/bls/generalform.pdf.

Section 3:

REPORTING RESPONSIBILITIES AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify all cases and susceptible exposed people rapidly, and to prevent further spread of this highly contagious disease.
- To identify the source of infection. Genotyping of viral isolates allows for determination of patterns of importation and transmission.
- To help in the international effort to eradicate measles.

B. Laboratory and Health Care Provider Reporting Requirements

Measles is reportable to the local board of health (LBOH). The MDPH requests that health care providers immediately report by telephone to the LBOH in the community where the case is diagnosed, all confirmed or suspect cases of measles, as defined by the reporting criteria in Section 2A.

Due to the potential significance of a measles case, the MDPH requests that information about any case also be immediately reported by telephone (24 hours per day, 7 days per week) to a MDPH immunization epidemiologist at the MDPH Division of Epidemiology and Immunization by calling (617) 983-6800 or (888) 658-2850.

Laboratories performing examinations on any specimens derived from Massachusetts residents that yield a measles virus IgM+ result shall immediately report such evidence of infection, directly by phone, to the MDPH Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850.

C. Local Board of Health (LBOH) Reporting and Follow-Up Responsibilities

Reporting Requirements

MDPH regulations *(105 CMR 300.000)* stipulate that measles is reportable to the LBOH and that each LBOH must report any case of measles or suspect case of measles, as defined by the reporting criteria in Section 2A. Cases should be reported as soon as possible (24 hours a day, 7 days a week) to a MDPH immunization epidemiologist at the MDPH Division of Epidemiology and Immunization by calling (617) 983-6800 or (888) 658-2850. A MDPH immunization epidemiologist, in collaboration with the LBOH, will complete the MDPH *Measles Case Report Form,* which can be found at the end of this chapter. Refer to the *Local Board of Health Timeline* at the end of this manual's *Introduction* section for information on prioritization and timeliness requirements of reporting and case investigation.

Case Investigation

Due to national surveillance and reporting requirements, the MDPH will take the lead on measles case investigation (including filling out the official case report form) and case management recommendations, in collaboration with the LBOH. The MDPH will keep the LBOH informed of all significant developments and will request the assistance of the LBOH as needed.

Essential components of case investigation include establishing a diagnosis of measles, obtaining immunization history for confirmed cases, identifying sources of infection, assessing potential for transmission, and obtaining specimens for viral isolation.

In order to assess the likelihood that a suspect case is a true case prior to laboratory testing, the MDPH and/or other public health staff helping in the investigation should ask about:

- Clinical presentation;
- Measles immunization history;
- Country of origin and length of residence in U.S. (those in the U.S. for a short time are more likely to be susceptible);
- Recent history of travel (to where and dates);
- Whether there were any recent out-of-town and out-of-country visitors (from where and dates);
- Whether there was any recent contact with anyone with similar symptoms;
- Risk factors for disease (e.g., <12 months of age, pregnancy, immunosuppression);
- Exposure and transmission settings (e.g., health care, childcare, school, institutional/residential settings [e.g., correctional, shelter, group home, military, and college—any setting where large numbers of foreign-born individuals are employed or live]); and
- Laboratory information, including viral isolation and serologic test results.

Institution of disease control measures is an integral part of case investigation. It is the responsibility of the LBOH to understand, and if necessary, institute the control guidelines listed in Section 4.

Section 4:
CONTROLLING FURTHER SPREAD

This section provides detailed control guidelines that are an integral part of case investigation. LBOH should familiarize themselves with the information. However, the MDPH will take the lead on implementing control measures for measles, in collaboration with the LBOH.

A. Isolation and Quarantine Requirements *(105 CMR 300.200)*

Minimum Period of Isolation of Patient

Through four days after onset of rash (counting the day of rash onset as day zero).

Minimum Period of Quarantine of Contacts

Students and staff who were born in or after 1957, who are not appropriately immunized and who do not have serologic evidence of immunity, will be excluded from school from the 5th through the 21st day after their exposure. If exposure was continuous and/or if multiple cases occur, susceptibles will be excluded through the 21st day after rash onset in the last case. Health care workers (or patients), regardless of year of birth, who are not appropriately immunized and who do not have laboratory evidence of immunity will be excluded from work (or isolated) from the 5th day after their first exposure through the 21st day after their last exposure. These restrictions remain even if the contact received immune globulin (IG). The MDPH may also recommend additional control measures.

B. Protection of Contacts of a Case

1. Implement control measures before serologic confirmation.
2. Inquire about contact with a known or suspect case or travel during the measles exposure period (8–18 days prior to onset).
3. Isolate the case during his/her infectious period, as defined above.
4. Identify all those exposed. Think in terms of the "zones of exposure," and consider members of the following groups, if they were in contact with the case during his/her infectious period.
   a. Household members,
   b. School/daycare contacts (students and staff),
   c. Staff and patients at medical facility where patient was seen (including staff with and without direct patient contact),
   d. Individuals at workplace of case (especially daycare centers, schools, and medical settings),
   e. Members of same religious/social groups,
   f. Members of sports teams and other extracurricular activity groups,
   g. Bus or carpool contacts,
   h. Close friends, and
   i. Persons potentially exposed at social events, travel sites, etc.

Note: Measles is so contagious that everyone at an entire institution is often considered exposed.

5. Identify high-risk susceptibles with whom the case had contact during his/her infectious period. Pregnant women, immunocompromised individuals, and infants <12 months of age should be referred to their health care providers.

6. Identify all other susceptibles. Susceptibles are those individuals without proof of immunity, as defined below:
   a. Born in the U.S. before January 1, 1957 (the exception to this is in the health care setting, where year of birth does not constitute acceptable proof of immunity);
   b. Two doses of measles-containing vaccine, given at least 4 weeks apart and beginning at ≥12 months of age, and the 2nd dose given prior to or within 72 hours of exposure. (In most situations, individuals receiving their first dose within 72 hours of exposure will be considered immune); or
   c. Serologic proof of immunity.

   Additionally, please note that:
   a. Foreign-born individuals must have documentation of immunization or serologic proof of immunity. "Born before 1957" is not acceptable (see below for explanation).
   b. Physician-diagnosed disease alone is not acceptable.
   c. Susceptibles include those with medical and religious exemptions to immunization.

   Year of Birth as Proof of Immunity

   Epidemiological data indicate that most individuals born in the U.S. before January 1, 1957 are immune to measles. This has not been found to apply to those born in other countries, where the epidemiology of measles was not the same and where measles immunization may not have been routine.

   Exceptions to the "1957 Rule" are those in health care settings. Because persons born before 1957 have both acquired and transmitted measles in health care settings, vaccination of these older employees, including those who were born in the U.S., with one dose of MMR vaccine is recommended. Please refer to Section 4C for more information about management in health care settings.

7. Immunize all susceptibles. Please review *Attachment B: Recommendations for Measles Immunization* and *Attachment C: Measles, Mumps, Rubella (MMR) Vaccine Fact Sheet*, both located at the end of this chapter. All susceptibles ≥12 months of age for whom vaccine is not contraindicated must be immunized, keeping in mind the following:

Measles vaccine given within 72 hours of exposure can prevent disease.

- The combined MMR vaccine is the preferred formulation for all those ≥12 months of age. It will provide additional protection against mumps and rubella.
- Vaccinating an individual who may be incubating measles is NOT harmful.
- Vaccinate susceptibles even if it is >72 hours post-exposure. It will protect against exposure to the next potential generation of cases. In addition, the situation should be viewed as an opportunity to vaccinate.
- MMR vaccine should never be given to infants <12 months of age. In addition, monovalent measles vaccine is not routinely given to this age group, unless indicated by local epidemiology.

8. Consider recommending IG for susceptibles with contraindications to measles vaccine if it is within six days of exposure. See *Attachment D: Use of Immune Globulin (IG)* (at the end of this chapter) for a list of such individuals, the recommended dosages, and subsequent deferral of live viral vaccines.
9. Isolation/exclusion (non-health care settings):
   a. Case: Isolate and exclude the case during his/her infectious period (from four days before through four days after rash onset, counting the day of rash onset as day zero). He/she may return to normal activities on the fifth day.

      Criteria for isolation/exclusion of case are more rigorous for immunocompromised individuals and for those in health care settings, as outlined in Section 4C.

   b. Contacts: Susceptibles include all unvaccinated individuals without proof of immunity as specified above, including:
      i. Individuals who receive IG,
      ii. Medical/religious exemptions from vaccination,
      iii. Individuals who have other contraindications to MMR vaccine; and
      iv. Those vaccinated >72 hours post-exposure.

   c. Isolate susceptibles on days 5–21 post-exposure. Several criteria are used to determine when to exclude susceptible contacts, and when they can return to normal activities, as outlined below.
      i. If there was a discrete (one-time) exposure: Exclude on days 5–21 from that exposure. They may return to normal activities on the 22nd day.
      ii. If there was continuous exposure: Exclude on days 5–21 from the day of rash onset in the case. (However, in health care settings, exclusion must begin 5 days after the earliest exposure and must extend through 21 days from the last exposure.) They may return to normal activities on the 22nd day.
      iii. If there is more than one case of measles: Susceptibles will need to be excluded until 21 days after the onset of rash in the last reported case in the outbreak setting. They may return to normal activities on the 22nd day.

Summary of Measles Exclusion Requirements

Case and Symptomatic Contacts	Asymptomatic Contacts
Exclude through the 4th day after rash onset (count day of rash onset as day zero). They may return to normal activities on the 5th day.	One case: Exclude susceptibles for 5–21 days post-exposure. Multiple cases: Exclude susceptibles for 21 days from date of rash onset in last case. Health care settings: Exclude or isolate susceptibles from 5 days after the earliest exposure through 21 days after the last exposure.

Note: Please refer to Section 4C for complete isolation/exclusion recommendations for cases and contacts in health care settings.

10. Conduct surveillance for 2 incubation periods (28 days) after rash onset in the last case or the last exposure in the setting, whichever is later.

C. Managing Special Situations

School Settings

Determine if there are any:

- Pregnant teachers, staff (including those without direct contact with students), and students (do not forget about student teachers) anywhere in the school.
- Immunocompromised individuals among the students, teachers, and staff anywhere in the school.
- Medical/religious exemptions anywhere in the school, among both students and staff. It is particularly important to identify these individuals in the classroom and grade of cases. Remember, these susceptible individuals (who do not get vaccinated) must also be excluded for the appropriate time period.
- Any extracurricular or sporting events that occurred during the infectious period.

Exclusion Criteria

- Susceptible contacts, including those in classrooms, extracurricular activities, and other settings, who have already received one dose of MMR and received a second dose of measles-containing vaccine within 72 hours of exposure can be readmitted; otherwise, they should be excluded, as above.
- In some settings, individuals who have received their first or second dose >72 hours post-exposure, but within a specified time period (as determined by the MDPH with the LBOH), may be allowed to continue to attend classes.
- In some rare settings where very high-risk susceptibles are present, the MDPH may recommend that susceptible students and staff be excluded, even if they have been immunized within 72 hours.

If multiple cases occur, guidelines may be revised to include other classrooms and teachers.

Notification

- Notify groups or schools exposed during the infectious period.
- Surveillance and control measures will need to be instituted in these settings.

Health Care Settings

Recommendations for health care facilities are more rigorous.

Proof of Immunity

Health care personnel have contributed to the spread of measles in medical settings. Therefore, documentation of immunity is extremely important.

- All staff born on or after January 1, 1957 should have proof of 2 doses of measles vaccine or serologic proof of immunity, with a 2nd dose having been given <72 hours after exposure.
- Medical personnel born before January 1, 1957 have acquired measles in medical facilities. Therefore, the MDPH recommends requiring at least one dose of measles vaccine for staff born before 1957 who do not have serologic proof of immunity.

- In special high-risk health care settings (e.g., transplant, oncology, or neonatal units), exclusion criteria should be even more rigorous. Infection control personnel may wish to exclude all susceptible personnel, even if they have been immunized within 72 hours of exposure.

Initial Management of Patients with Febrile Rash Illness

- Assess and screen all patients with febrile rash illness, either prior to or immediately on arrival at the intake area.
- Escort patients to a separate waiting area or place immediately in a private room.
- Both patients and staff should wear appropriate masks/respirators (masks for patients to prevent generation of droplets, and respirators for staff, if possible, to filter airborne particles).
- If not admitted, maintain standard and airborne infection isolation (including while patient is exiting the facility; e.g., separate exit). Patients should receive instructions to remain in isolation at home through four days after rash onset.
- Measles virus can remain suspended in the air for up to two hours. Therefore, we recommend that susceptible patients NOT be placed in a room that has been occupied by a suspect case for two hours following the case's exit from that room.

Infectious Period

- Cases are considered to be infectious from four days before rash onset through four days after rash onset, counting the day of rash onset as day zero. Therefore, cases are considered infectious for a total of nine days.
- Immunocompromised patients may have prolonged excretion of virus in their secretions, and should be considered infectious for the duration of their illness.

Exclusion/Isolation of Cases

- Personnel who become sick should be excluded from work for four days after they develop a rash consistent with measles. They may return on the fifth day.
- If admitted, patients should be on airborne infection isolation (in addition to standard precautions) while infectious (four days before rash onset through four days after rash onset) in a negative pressure room. They may be taken off isolation on the fifth day.
- If not admitted, patients should maintain respiratory isolation while exiting the facility (e.g., mask, separate exit) and should remain at home through four days after rash onset. They may return to normal activities on the fifth day.

Exclusion/Isolation of Contacts

The exclusion/isolation periods are extended in the health care setting:

- Susceptible staff contacts should be excluded from the 5th day after the earliest exposure through the 21st day after the last exposure to the case during his/her potential infectious period (as defined above). They may return on the 22nd day.
- Susceptible patient contacts should be placed in isolation from day 5 after the earliest exposure through day 21 after the last exposure to the case during his/her potential infectious period (as defined above). They may be taken off isolation on the 22nd day.

The above recommendations are summarized in the table, "Measles Control in Medical Settings," on the next page.

Measles Control in Medical Settings

This table summarizes additional control measures to decrease nosocomial measles transmission.

1. Assess and screen all patients with rash illness, either prior to or immediately on arrival at intake area.
2. Escort patients with rash illness or suspect measles to a separate waiting area or private room.
3. Both patients and staff should wear appropriate masks/respirators (masks for patients to prevent generation of droplets, and respirators for staff, if possible, to filter airborne particles).
4. If admitted: Maintain on airborne infection isolation (in addition to standard precautions) while infectious in a negative pressure room. (Patients are considered infectious for four days before through four days after rash onset, counting the day of rash onset as day zero.)
5. If not admitted: Maintain respiratory precautions, including while patient is exiting the facility (e.g., mask, separate exit). Patient should remain in isolation at home through four days after rash onset, counting the day of rash onset as day zero. The patient may resume normal activities on the fifth day.
6. Avoid placing susceptibles in a room which has been occupied by a suspect case for two hours following the case's exit.
7. Identify all contacts among patients and staff. This includes:
   a. Patients and families in the waiting and examination rooms up to two hours after index case was present;
   b. All staff both with and without direct patient contact; and
   c. Due to airborne route of transmission, everyone at the entire facility.
8. Identify susceptibles (particularly high-risk susceptibles) and offer:
   a. MMR within 72 hours of exposure (will most likely prevent illness if given in this time period); or
   b. For high-risk susceptibles and those ineligible for vaccination, IG $\leq$6 days after exposure (may modify or prevent illness, but a recipient can still be infectious).
9. Notify infection control, employee health, department heads, and the health care providers of exposed patients. Put up "Measles Alerts." (This may be obtained from a MDPH immunization epidemiologist at the MDPH Division of Epidemiology and Immunization at [617] 983-6800 or [888] 658-2850.)
10. Exclusion of susceptibles:
    a. All staff born in or after 1957, who have not received a second dose of measles vaccine $\leq$72 hours post exposure, must be excluded from five days after their earliest exposure through 21 days after their last exposure to the case during his/her potential infectious period.
    b. All staff born before 1957 who have not received 1 dose of MMR $\leq$72 hours post-exposure must be excluded 5–21 days post-exposure.
    c. Staff who contract measles should be excluded for four days after rash onset.
    d. In special high-risk health care settings (e.g., transplant, oncology, or neonatal units) exclusion criteria should be even more rigorous. Infection control personnel may wish to exclude all susceptible personnel, even if they have been immunized within 72 hours.

Management and MMR Vaccination of HIV-Infected Individuals and Their Contacts

Management of HIV-Infected Individuals Exposed to Measles

1. MMR or IG should be given, depending on the situation:
    a. Asymptomatic HIV-infected individuals who are not severely immunosuppressed (i.e., with higher age-specific CD4+ T-lymphocyte counts or percentages than those in the table on the next page), if susceptible and exposed ≤3 days prior should receive MMR vaccine.
    b. Asymptomatic HIV-infected individuals who are not severely immunosuppressed (i.e., with higher age-specific CD4+ T-lymphocyte counts or percentages than those in the table on the next page), if susceptible and exposed >3–6 days prior should receive IG 0.25cc/kg IM (maximum 15cc). They should subsequently be immunized with MMR after the appropriate interval. Please refer to the table in *Attachment D: Use of Immune Globulin (IG)*, "Suggested Intervals between Administration of Immunoglobulin Preparations and Measles-Containing and Varicella Vaccines."
    c. Symptomatic HIV-infected individuals who are severely immunosuppressed (as defined in the table on the next page), regardless of past history of immunization or disease, unless they have recent serologic proof of immunity, should receive IG 0.5cc/kg IM (15cc max).

2. If an individual has received Immune Globulin Intravenous preparation (IGIV) (400 mg/kg) ≤3 weeks before exposure, no additional IG is required. However, some experts recommend an additional dose of IGIV if ≥2 weeks have elapsed since last treatment. (Remember, when deciding to vaccinate these individuals, MMR vaccine should be given ≥2 weeks before any IG or other blood products.)

Management of Contacts of HIV-Infected Individuals Who Are Themselves Exposed to Measles

1. If they are susceptible and exposed three days prior, they should receive MMR vaccine.
2. If they are susceptible and exposed >3–6 days prior, they should receive IG. Those receiving IG should subsequently be immunized with MMR after the appropriate interval. Please refer to the table in *Attachment D: Use of Immune Globulin (IG)*, "Suggested Intervals between Administration of Immunoglobulin Preparations and Measles-Containing and Varicella Vaccines."

General Guidelines for the Use of MMR Vaccine in HIV-infected and Potentially HIV-infected Individuals

1. Prevaccination HIV testing is NOT recommended.
2. MMR vaccine is recommended for routine immunization of individuals with asymptomatic HIV infection who do not have evidence of severe immunosuppression.
3. MMR vaccine should be considered for all symptomatic HIV-infected persons who do not have evidence of severe immunosuppression, as defined in the table on the next page.
4. It is recommended that severely immunocompromised HIV-infected individuals (as defined by low CD4+ counts or low percent of CD4+ circulating lymphocytes—see table on the next page) should NOT receive MMR or other measles-containing vaccines.

Measles-containing vaccines are *contraindicated* in those with the following:

Age Group	Total CD4+ Count	or	CD4+ as a % of Total Lymphocytes
<12 months	<750/mcL	or	<15%
1–5 years	<500/mcL	or	<15%
6–12 years	<200/mcL	or	<15%
≥13 years	<200/mcL	or	<14%

5. Since the immunologic response to vaccines is often poor in HIV-infected patients, the first dose of MMR should be given as early as possible after 12 months of age. This will increase the chance of an adequate immune response before further deterioration of the immune system.
6. Give the 2nd dose of MMR 4 weeks after the 1st. This will increase the likelihood of seroconversion.
7. During outbreak situations only, consider giving the 1st dose of monovalent measles vaccine at 6–11 months of age to those infants who are not severely immunocompromised. Remember, these children must be revaccinated with 2 doses of MMR beginning at 12 months of age. Mumps and rubella vaccines cannot be given at <12 months of age.

D. Preventive Measures

Personal Preventive Measures/Education

Vaccination, including routine childhood vaccination, catch-up vaccination of adolescents, and targeted vaccination of high-risk adult groups (including international travelers), is the best preventive measure against measles. It is particularly important to vaccinate susceptible household contacts of high-risk susceptibles who cannot themselves be vaccinated, such as immunocompromised individuals, pregnant women, and infants. Good personal hygiene (which consists of proper handwashing, disposal of used tissues, not sharing eating utensils, etc.) is also important in preventing measles.

Please refer to the *References* section, the most current versions of MDPH's *Immunization Guidelines,* MDPH's *Model Standing Orders for MMR Vaccine*, and *Massachusetts Immunization Program State-Supplied Vaccines and Patient Eligibility Criteria,* for recommended schedules, groups recommended, and groups eligible to receive state-supplied vaccine. These, as well as other relevant resources, are available through the MDPH Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850 and on the MDPH website at www.mass.gov/dph/cdc/epii/imm/imm.htm#mso.

ADDITIONAL INFORMATION

The following is the formal CDC surveillance case definition for measles. It is provided for your information only and should not affect the investigation and reporting of a case that fulfills the criteria in Section 2A of this chapter. (The CDC and the MDPH use the CDC case definitions to maintain uniform standards for national reporting on a national basis.) For reporting to the MDPH, always use the criteria outlined in Section 2A.

Note: The most up-to-date CDC case definitions are available on the CDC website at www.cdc.gov/epo/dphsi/casedef/case_definitions.htm.

Case Definition for Measles

Clinical Case Definition

An illness characterized by all the following:

- A generalized maculopapular rash lasting ≥3 days;
- A temperature ≥101°F (38.3°C); and
- Cough, coryza, or conjunctivitis.

Laboratory Criteria for Diagnosis

- Positive serologic test for measles IgM antibody;
- Significant rise in measles antibody level by any standard serologic assay; or
- Isolation of measles virus from a clinical specimen.

Case Classification

Suspect	Febrile illness accompanied by generalized maculopapular rash.
Probable	A case that meets the clinical case definition, has noncontributory or no serologic or virologic testing, and is not epidemiologically-linked to a confirmed case.
Confirmed	A case that is laboratory-confirmed or that meets the clinical case definition and is epidemiologically-linked to a confirmed case. A laboratory-confirmed case does not need to meet the clinical case definition.

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ATTACHMENTS

Attachment A: Specimen Collection for Diagnosis of Measles

Attachment B: Recommendations for Measles Immunization

Attachment C: Measles, Mumps, Rubella (MMR) Vaccine Fact Sheet

Attachment D: Use of Immune Globulin (IG)

Attachment A

MDPH Division of Epidemiology and Immunization and
SLI Virus Isolation Laboratory—Room 815

Specimen Collection for Diagnosis of Measles

Antibody Detection

Submission of specimens to the MDPH State Laboratory Institute (SLI), Virus Isolation Laboratory must be coordinated through a MDPH immunization epidemiologist at (617) 983-6800 or (888) 658-2850. Technical questions about specimen collection can be addressed to the SLI Virus Isolation Laboratory at (617) 983-6383 or (617) 983-6396.

Specimen Type	Serum for IgM Antibody (Serology for Acute Infection)
Collection Procedure	Venipuncture. Serum-separator tubes (SST) preferred, red-top tubes acceptable.
Optimum Collection Time	Acute specimen should be collected ≥3 days after rash onset. Follow-up specimens for additional testing may be required.
Transportation Container	Serum only, in polystyrene (plastic) tube, or centrifuged blood in SST.
Volume	2 mL serum; ≥0.5 mL may be acceptable for young children.
Transport	Cold, use ice packs. **DO NOT FREEZE**.

Serum for IgG antibody testing is performed at the SLI under special circumstances, after consultation with a MDPH immunization epidemiologist. If approved, follow same procedures described above.

Viral Isolation

Specimen Collection for Isolation of Measles Virus

Clinical specimens for viral isolation are needed in addition to serum specimens for serological measles diagnosis. Throat (oropharyngeal) or nasopharyngeal (NP) swabs and/or urine are all considered to be good for measles virus recovery. When collecting specimens for viral isolation, collection of both throat (or NP) swabs and urine enhance the possibility for virus isolation. Urine samples may not be feasible for infants, and throat or NP swabs are preferred rather than urine collected using infant urine collection devices.

Submission of specimens must be coordinated with a MDPH immunization epidemiologist at (617) 983-6800 or (888) 658-2850, who can also facilitate the shipment of specimens to the SLI in a timely manner.

Updated 3/2005

Specimen Collection for Isolation of Measles Virus

	Urine	Throat Swab (Oropharyngeal Swab)	Nasopharyngeal (NP) Swab (This is an alternative for infants and others in whom oropharyngeal specimens may not be possible. A NP swab may be pooled with a throat swab to ensure an adequate sample.)
Collection Procedure	Collect clean void, first morning urine if possible.	Collect specimen by using a cotton/dacron swab. Swab the posterior pharynx and tonsillar areas, avoiding the tongue (tongue depressor may be helpful). The mucosa behind the uvula and between the tonsils should be gently swabbed with a back-and-forth motion.	Collect specimen by using a cotton/dacron swab. Insert swab into nostril parallel to the palate (nasopharynx). Rotate swab to absorb secretions and remove. If possible, leave swab in place for several seconds to absorb secretions.
Optimum Collection Time	Optimal collection for virus isolation is within the first three days of rash onset. After five days, the recovery of virus is much reduced. Virus may be detected by PCR up to 14 days after rash onset and possibly beyond, particularly if the patient is immunosuppressed. (In this case, consult with the SLI about timing of specimen collection.)	Same as for urine collection.	Same as for urine collection and throat swab.
Transportation Container	Sterile plastic screw-capped container.	Place swab in Viral Transport Media (VTM). Any sterile isotonic fluid, like phosphate buffered saline (PBS) or common tissue medium like Eagle's MEM can be used. Commercially available kits containing swabs and viral transport media are acceptable (e.g., BECTON DICKINSON). Swabs may be broken off and shipped with media. Keeping swabs moist is most important. Alternatively, swirl/agitate the swab in the media for several minutes before removal.	Place cotton/dacron swab in Viral Transport Media (VTM). Any sterile isotonic fluid, like phosphate buffered saline solution (PBS) or common tissue medium like Eagle's MEM, can be used. Commercially available kits containing swabs and viral transport media are acceptable (e.g., BECTON DICKINSON). Keeping swabs moist is most important. Alternatively, swirl/agitate the swab in the media for several minutes before removal.
Volume	10–50 mL	3–5 mL of VTM	3 mL of VTM
Transport	Cold, on-ice packs. It is important to ship on day of collection (except Friday) if possible. Use next morning delivery.	Cold, on-ice packs should be received at the laboratory within 48 hours of collection. If shipment is delayed and facilities are available, the specimens should be frozen at -70ºC and shipped on dry ice. Otherwise, store specimens in refrigerator (freezing at -20ºC reduces viability of virus).	Cold, on-ice packs should be received at the laboratory within 48 hours of collection. If shipment is delayed and facilities are available, the specimens should be frozen at -70ºC and shipped on dry ice. Otherwise, store specimens in refrigerator (freezing at -20ºC reduces viability of virus).

Coordinate specimen submission with the MDPH Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850.

Attachment B

Recommendations for Measles Immunization

Category	Recommendations
Unimmunized, no history of measles (12–15 months of age)	A 2-dose schedule (with MMR) is recommended. The 1st dose is recommended at 12–15 months of age; the 2nd is recommended at 4–6 years of age
Children 6–11 months of age in epidemic situations	Immunize (with monovalent measles vaccine, or if not available, MMR); reimmunize (with MMR) at 12–15 months of age if necessary. A 3rd dose is indicated at 4–6 years of age
Children 4–12 years of age who have received 1 dose of measles vaccine at ≥12 months of age	Reimmunize (one dose of MMR)
Students in college and other post-high school institutions who have received 1 dose of measles vaccine at ≥12 months of age	Reimmunize (one dose of MMR)
History of immunization before the first birthday	Consider susceptible and immunize (two doses of MMR)
History of receipt of inactivated measles vaccine or unknown type of vaccine, 1963–1967	Consider susceptible and immunize (two doses of MMR)
Further attenuated or unknown vaccine given with IG	Consider susceptible and immunize (two doses of MMR)
Allergy to eggs	Immunize; no reactions likely (see *Attachment C: Measles, Mumps, Rubella (MMR) Vaccine Fact Sheet* for details)
Neomycin allergy, nonanaphylactic	Immunize; no reactions likely (see *Attachment C: Measles, Mumps, Rubella (MMR) Vaccine Fact Sheet* for details)
Tuberculosis	Immunize; vaccine does not exacerbate infection
Measles exposure	Immunize and/or give immune globulin (IG), depending on circumstances
HIV-infected	Immunize (two doses of MMR), unless severely immunocompromised
Personal or family history of seizures	Immunize; advise patient of slightly increased risk of seizures
Immunoglobulin or blood recipient	Immunize at the appropriate interval (interval is product dependent*)

* Please refer to the table, "Suggested Intervals between Administration of Immunoglobulin Preparations and Measles-Containing and Varicella Vaccine," located in *Attachment D: Use of Immune Globulin (IG)* for more information.

Adapted from American Academy of Pediatrics. [Measles.] In: Pickering L.K., ed. *Red Book: 2003 Report of the Committee on Infectious Diseases, 26th Edition.* March 2005: 425.

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Attachment C

Measles, Mumps, Rubella (MMR) Vaccine Fact Sheet

The following should be considered when administering measles, mumps, rubella (MMR) vaccine or vaccines that contain one or more MMR component:

A. Allergy to Eggs

Hypersensitivity to eggs is not a contraindication per the American Academy of Pediatrics (AAP) and Advisory Committee on Immunization Practices (ACIP). Most allergic reactions following administration of MMR have been attributed to trace amounts of gelatin, neomycin, or other vaccine component (see below). Recent data have demonstrated the safety of MMR vaccine, even in those with a history of egg anaphylaxis. Skin testing is not predictive and not recommended in persons with a history of egg allergy.

Recommendations

Routinely vaccinate, as indicated, those with an egg allergy with any of these vaccines:

- Monovalent measles vaccine,
- Monovalent mumps vaccine,
- Monovalent rubella vaccine (rubella vaccine is not grown in chicken embryo cell culture), or
- MMR vaccine.

B. Allergic Reactions to Neomycin and Gelatin

Neomycin allergy most often manifests as a contact dermatitis. Non-anaphylactic reactions to either neomycin or gelatin are NOT contraindications to MMR vaccine.

Recommendations

Persons who have experienced true anaphylactic reactions to topically or systemically administered neomycin or to gelatin should receive MMR vaccine only in settings where such reactions can be managed and after consultation with an allergist or immunologist.

C. MMR Vaccine and Autism, Associated Disorders, and Inflammatory Bowel Disease

The Institutes of Medicine (IOM) Immunization Safety Review Committee has concluded that the recent increases in autism and related disorders are not attributable to MMR vaccine. The AAP convened a panel of experts that also found that the available evidence does not support the hypothesis that MMR vaccine causes autism, associated disorders, or inflammatory bowel disease.

Recommendations

Follow existing recommendations for routine use of MMR vaccine at 12–15 months of age and a 2nd dose at 4–6 years of age.

D. Acute Arthritis/Arthralgia

Arthralgia (joint pain) and arthritis can occur in susceptible individuals post-vaccination with MMR. Joint pain has been reported in 0.5% of children. Up to 25% of post-pubertal females may develop arthralgia, and up to 10% may develop transient arthritis. If joint symptoms do occur post-vaccination, they generally begin 1–3 weeks post vaccination, are transient, and last only 1–21 days. Symptoms of acute arthritis/arthralgia are much less common post-vaccination than with natural disease.

Recommendations

Vaccinate susceptible women of childbearing age because the potential risks of a susceptible woman having a child with congenital rubella syndrome (CRS) far outweigh risks of adverse events related to joint abnormalities.

E. Thrombocytopenia Purpura

MMR can rarely cause clinically apparent thrombocytopenia within 2 months of vaccinations, with temporal clustering 2–3 weeks after vaccination. Reported cases have been transient and benign in outcome. The estimated number of cases is 2 per 1 million doses distributed in the U.S. However, based on these case reports, the risk of vaccine-associated thrombocytopenia may be higher for those who have had a previous episode of thrombocytopenia, especially if it occurred in temporal association with earlier MMR vaccination.

Recommendations

If an individual has a prior history of thrombocytopenia:

- Check for serologic immunity (if immune, vaccination is NOT indicated), and
- Assess risk/benefit of vaccination.

In most cases, the benefits of vaccination will justify giving the vaccine.

F. Altered Immune Status

Enhanced replication of vaccine viruses may occur in persons who have immune deficiency disorders and are immunocompromised. For some of these conditions, all affected persons are severely immunocompromised. The degree to which the immune system is compromised depends on the severity of the condition, which in turn depends on the disease or treatment stage. The patient's health care provider must assume responsibility for determining whether the patient is severely immunocompromised based on clinical and laboratory assessment.

Recommendations

- Do not administer MMR vaccine to patients who are severely immunocompromised for any reason.
- Administer MMR vaccine to healthy susceptible contacts of severely immunocompromised persons.

G. MMR Vaccine for HIV-Infected Individuals

Because measles can be severe and often fatal in patients with HIV infection, MMR vaccine is recommended for people with asymptomatic HIV infection who are not severely immunocompromised. Severely immunocompromised HIV-infected patients, as defined by low CD4+ T-lymphocyte counts (considering age), should not receive measles virus-containing vaccine because vaccine-related pneumonia has been reported.

Recommendations

- Routine pre-vaccination HIV testing is NOT recommended.
- Administer MMR vaccine for routine immunization of individuals with asymptomatic HIV infection who do not have evidence of severe immunosuppression.
- Consider MMR vaccine for all symptomatic HIV-infected persons who do not have evidence of severe immunosuppression, as defined in the table below.

Measles-containing vaccines are contraindicated in those with the following:

Age Group	Total CD4+ Count	or	CD4+ as a % of Total Lymphocytes
<12 months	<750/mcL	or	<15%
1–5 years	<500/mcL	or	<15%
6–12 years	<200/mcL	or	<15%
≥13 years	<200/mcL	or	<14%

Source: CDC. Measles, Mumps and Rubella—Vaccine Use and Strategies for Elimination of Measles, Rubella, and Congenital Rubella Syndrome, and Control of Mumps: Recommendations of the ACIP. *MMWR*. 1998; 47(RR-8): 21.

- Do not administer MMR or other measles-containing vaccines to severely immunocompromised HIV-infected individuals (as defined by low CD4+ counts or low percent of CD4+ circulating lymphocytes—see above table).
- Since the immunologic response to vaccines is often poor in HIV-infected patients, give the 1st dose of MMR as early as possible after 12 months of age. This will increase the chance of an adequate immune response, before further deterioration of the immune system can occur.
- Give the 2nd dose of MMR 4 weeks after the first. This will increase the likelihood of seroconversion.
- During outbreak situations only, consider giving the 1st dose of monovalent measles vaccine (or MMR if monovalent measles vaccine is not available) at 6–11 months of age to those infants who are not severely immunocompromised. Remember, these children must be revaccinated with 2 doses of MMR beginning at 12 months of age. If possible, avoid giving mumps and rubella at <12 months of age.
- Administer MMR vaccine to health contacts of severely immunocompromised persons.

H. Live Virus Vaccines and Immunosuppressive Therapy

Recommendations

- After chemotherapy and other immunosuppressive therapy (except steroids—see table on next page), defer MMR vaccine for ≥3 months.
- For patients on steroids, defer live virus vaccines as outlined in the table on the next page.

Guidelines for Administration of Live Virus Vaccines and Steroid Therapy *

Steroid Therapy	Recommendations for Deferral
High dose systemic steroids daily or on alternate days for ≥14 days (≥2mg/kg QD or ≥20mg QD of prednisone)	Defer live virus vaccines for ≥1 month after treatment has stopped.
High dose systemic steroids daily or on alternate days for <14 days (≥2 mg/kg QD or ≥20 mg QD prednisone)	Can give live virus vaccines immediately after treatment is discontinued. However, some experts recommend deferring until two weeks after treatment has stopped, if possible.
Low or moderate doses of systemic steroids given daily or on alternate days (<2 mg/kg QD or <20 mg QD of prednisone); or physiologic maintenance doses of steroid (replacement therapy)	Can give live virus vaccines on treatment.
Topical, aerosol, or local injections of steroids (e.g., skin, aerosol, eyes, intra-articular, bursal, tendon injections)	Can give live virus vaccines on treatment. However, if this therapy is prolonged and there is any clinical or laboratory evidence of immunosuppression, defer for ≥1 month after treatment has stopped.
Individuals with a disease which in itself is considered to suppress the immune response and who are receiving systemic or locally acting steroids	Should not give live virus vaccines, except in special circumstances.

Adapted from: American Academy of Pediatrics. [Immunization in Special Clinical Circumstances.] In: Pickering L.K., ed. *Red Book: 2003 Report of the Committee on Infectious Diseases, 26th Edition*. 2003: 74–75.

Steroid therapy is not a contraindication for administration of killed vaccines.

I. MMR Vaccine and Pregnant Women

MMR vaccine is contraindicated in pregnant women due to the theoretical risk to the fetus. To date, there are no data demonstrating any ill effects on developing fetuses. Current data, estimated risk, and recommendations are outlined below.

Rubella

There is no evidence that rubella vaccine causes CRS. However, pregnant women should not be immunized due to the theoretical risk to the fetus, estimated to be potentially, on a statisitcal basis, 0–1.6%, based on data accumulated by the CDC on 226 susceptible women who received the current RA27/3 vaccine strain during the first trimester. Only 2% of the babies had asymptomatic infection but none had congenital defects. This risk is substantially less than the ≥20% risk for CRS associated with maternal infection in the first trimester of pregnancy. In view of these observations, receipt of rubella vaccine in pregnancy is not an indication for termination of pregnancy.

Mumps

There is no evidence that mumps vaccine will cause mumps infection in an unborn fetus. Live mumps vaccine can infect the placenta, but the virus has not been isolated from fetal tissue.

Measles

There is no evidence that measles vaccine will cause measles infection in an unborn fetus.

Recommendations

- Screening: Ask women of childbearing age if they are pregnant. Routine prevaccination pregnancy testing is NOT recommended. The American College of Obstetricians and Gynecologists (ACOG), the ACIP, and the AAP all state that it is sufficient to screen by asking a woman if she is pregnant.
- Patient Advice: Inform women of the theoretical risk to the fetus if they are pregnant or plan to become pregnant within four weeks following vaccination. In view of this theoretical risk, advise them not to become pregnant for four weeks following MMR vaccine.
- Vaccination: Do not vaccinate women who are pregnant.
- Documentation: Date of last menstrual period (LMP) and the advice given to the patient may be documented in the woman's chart.

J. MMR and Tuberculosis (TB) Testing

Measles vaccination may temporarily suppress tuberculin skin test reactivity.

Recommendation

If TB testing cannot be done the day of MMR vaccination, postpone the test for 4–6 weeks.

K. Invalid Doses

Consider doses of measles, mumps, or rubella vaccines invalid in the following situations:

- Received before first birthday.
- Received after recent receipt of IG (please refer to *Attachment D: Use of Immune Globulin [IG]*).
- Killed measles vaccine.
- Killed measles vaccine, followed by live vaccine within three months (both doses are invalid).
- Measles vaccine of unknown type received prior to 1963–1967.
- Simultaneous receipt of IG and either a further attentuated measles vaccine (i.e., containing Schwartz or Moraten strains) or measles vaccine of unknown type.
- Killed mumps vaccine.
- Mumps vaccine of unknown type received prior to 1979.
- Live rubella vaccine accompanied by IG.

Revaccination with MMR is recommended for eligible individuals such that at least two valid doses of measles-containing vaccine, one of mumps, and one of rubella are documented.

Updated 9/2005

Attachment D

Use of Immune Globulin (IG)

A. Indications for IG in Susceptibles with Contraindications to Measles Vaccine

IG given ≤6 days post-exposure can modify disease or prevent illness. It is unlikely to be effective if given >6 days post-exposure. IG should be considered for all immunocompromised patients. If patients are severely immunocompromised, IG should be given regardless of past history of vaccination (unless they have recent serologic proof of immunity). IG is also indicated for susceptible pregnant women and infants <12 months of age with contraindications to measles-containing vaccine or one of its components.

The dose of IG depends on the underlying medical condition of the patient, as outlined below:

1. IG 0.25cc/kg IM (maximum 15cc) should be given to:

   - Susceptible pregnant women;
   - Immunocompromised individuals (non-HIV-infected) who are not severely immunosuppressed;
   - Susceptible asymptomatic HIV-infected individuals (with CD4+ cell counts >200) if exposed 3–6 days prior (if exposed ≤3 days prior, they should receive MMR);
   - Infants <12 months of age;
   - Those with anaphylactic reactions to neomycin or gelatin; and
   - Those with other contraindications for measles-containing vaccine;

   (Egg-hypersensitivity is NO LONGER considered a contraindication.)

2. IG 0.5cc/kg IM (maximum 15cc) should be given to:

   - Symptomatic HIV-infected individuals who are severely immunosuppressed (those with CD4+ cell counts <200 or equivalent CD4+ counts for children) regardless of past history of immunization, unless they have recent serologic proof of immunity.

3. If IGIV (100–400mg/kg) has been given ≤3 weeks before exposure:

   - That individual should be considered protected and no additional IG is needed. However, some experts recommend an additional dose of IGIV if ≥2 weeks have elapsed since the last dose.

Note: Although IG can modify illness, INDIVIDUALS CAN STILL BECOME INFECTIOUS AND MUST BE ISOLATED AND EXCLUDED.

B. Immune Globulin (IG) and Live Vaccines

1. IG can inhibit the immune response to some live vaccines. After an individual has received IG or other blood products, these vaccines should be deferred for the appropriate time interval, after IG administration, as outlined below:

Measles Vaccine	Interval is IG-dose dependent and measles-containing vaccines should be deferred for: ◆ ≥5 months, if received the 0.25 cc/kg dose; ◆ ≥6 months, if received the 0.5 cc/kg dose; ◆ 3–11 months, if received any other blood product. Please refer to the table on the next page, "Suggested Intervals between Administration of Immunoglobulin Preparations and Measles-Containing and Varicella Vaccines."
Mumps Vaccine	Should be deferred ≥3 months.
Rubella Vaccine	Should be deferred ≥3 months.
Varicella Vaccine	Interval is IG-dose dependent and vaccine should be deferred for 3–11 months. Please refer to the table on the next page, "Suggested Intervals between Administration of Immunoglobulin Preparations and Measles-Containing and Varicella Vaccines."
Oral Typhoid Vaccine and Oral Polio Vaccine	Response to this vaccine is not affected by IG or blood products.
Live Viral Vaccines	Response to these vaccines is not affected by Respiratory Syncytial Virus immune globulin (RSVIG) IM.
Inactivated Vaccines	Response to these vaccines is not affected by IG or blood products.

2. Conversely, if MMR and varicella vaccines were given before IG or blood products, these products should be deferred for ≥2 weeks (if possible). This allows adequate immune response to develop. If these products cannot be deferred for ≥2 weeks, the individual should be either revaccinated or tested for serologic immunity and revaccinated, after the interval specified in the table on the next page, "Suggested Intervals between Administration of Immunoglobulin Preparations and Measles-Containing and Varicella Vaccines."

Suggested Intervals between Administration of Immunoglobulin Preparations and Measles-Containing and Varicella Vaccines

Product/Indication	Dose (including mg immunoglobulin G (IgG)/kg body weight[1])	Recommended Interval Before Measles or Varicella Vaccination (months)
Respiratory syncytial virus immune globulin (RSVIG) monoclonal antibody (Synagis™)	15 mg/kg intramuscularly (IM)	None
Tetanus IG	250 units (10 mg IgG/kg) IM	3
Hepatitis A IG		
Contact prophylaxis or international travel <3 months	0.02 mL/kg (3.3 mg IgG/kg) IM	3
International travel 3–5 months	0.06 mL/kg (10 mg IgG/kg) IM	3
Hepatitis B IG	0.06 mL/kg (10 mg IgG/kg) IM	3
Rabies IG	20 IU/kg (22 mg IgG/kg) IM	4
Varicella IG	125 units/10 kg (20–40 mg IgG/kg) IM, maximum 625 units	5
Measles prophylaxis IG		
Standard (i.e., non-immunocompromised) contact	0.25 mL/kg (40 mg IgG/kg) IM	5
Immunocompromised contact	0.50 mL/kg (80 mg IgG/kg) IM	6
Blood transfusion		
Red blood cells (RBCs), washed	10 mL/kg negligible IgG/kg intravenously (IV)	None
RBCs, adenine-saline added	10 mL/kg (10 mg IgG/kg) IV	3
Packed RBCs (hematocrit 65%)	10 mL/kg (60 mg IgG/kg) IV	6
Whole blood (hematocrit 35–50%)	10 mL/kg (80–100 mg IgG/kg) IV	6
Plasma/platelet products	10 mL/kg (160 mg IgG/kg) IV	7
Cytomegalovirus intravenous immune globulin (IGIV)	150 mg/kg maximum IV	6
Respiratory syncytial virus prophylaxis IGIV	750 mg/kg IV	9
IGIV		
Replacement therapy for immune deficiencies	300–400 mg/kg IV	8
Immune thrombocytopenic purpura	400 mg/kg IV	8
Immune thrombocytopenic purpura	1,000 mg/kg IV	10
Kawasaki disease	2 grams/kg IV	11

Note on other live vaccines: Blood and other antibody-containing products (except washed red blood cells) can also diminish the response to rubella vaccine and potentially to mumps vaccine. Therefore, after IG preparations or other antibody-containing products are received, mumps and rubella vaccines should be deferred for ≥3 months. If RSV-IGIV is given, mumps, rubella and varicella vaccines should be deferred for ≥9 months. If RSVIG IM is given, no deferral is needed for any live virus vaccines.

Adapted from: CDC. General Recommendations on Immunization: Recommendations of the Advisory Committee on Immunization Practices (ACIP) and the American Academy of Family Physicians (AAFP). *MMWR*. 2002; 51(RR-2): 7.

Updated 2/2005

FORMS & WORKSHEETS

Measles

Measles

REPORT IMMEDIATELY

LBOH Action Steps

This form does not need to be submitted to the MDPH with the case report form. It is for LBOH use and is meant as a quick-reference guide to measles case investigation activities.

LBOH staff should follow these steps when measles is suspected or confirmed in the community. For more detailed information, including disease epidemiology, reporting, case investigation, and follow-up, refer to the preceding chapter.

Note: Due to the potential severity of measles, as well as national surveillance and reporting requirements, MDPH epidemiologists will usually take the lead on measles investigations. This includes filling out the official case report form and making case management recommendations, in collaboration with the LBOH. MDPH epidemiologists will keep the LBOH informed of all significant developments and will request the assistance of the LBOH as needed.

Reporting

- ❑ Immediately notify the MDPH Division of Epidemiology and Immunization, at (617) 983-6800 or (888) 658-2850, to report any confirmed or suspect case(s) of measles.

Case Investigation

- ❑ Work with MDPH to ensure that appropriate clinical specimens are collected and submitted to the SLI for confirmation.
- ❑ Work with MDPH to obtain the information necessary for completion of the case report form, including source of exposure, clinical information, vaccination history, laboratory results, and source of infection. (MDPH will complete the form and submit to the MDPH Bureau of Communicable Disease Control, Office of Integrated Surveillance and Informatics Services [ISIS].)

Prevention and Control

- ❑ Work with MDPH to institute isolation and quarantine requirements *(105 CMR 300.200)* and other control measures, as they apply to a particular case.
- ❑ Identify high-risk (e.g., pregnant women) or susceptible individuals, including those with medical or religious exemptions.
- ❑ Vaccinate susceptible individuals with MMR within 72 hours of exposure, if possible (if not contraindicated). Remember, measles vaccination within this time period most likely will prevent illness in susceptibles.
- ❑ Conduct surveillance for two incubation periods.

Managing Measles in Schools and Other Institutions

In addition to the prevention and control measures described above:

- ❑ Notify and educate staff, students, and/or patients.
- ❑ Test and exclude symptomatic individuals.
- ❑ Isolate remaining susceptible contacts. (In most settings, individuals vaccinated within 72 hours of exposure can be readmitted to a facility.)

Managing Measles in Health Care Settings

In addition to the prevention and control measures described above:

- ❑ Notify infection control or employee health of confirmed or suspect case(s) in institution.
- ❑ Ensure all health care personnel have proof of immunity appropriate for health care setting.
- ❑ Use more rigorous criteria for exclusion/isolation for susceptibles in health care setting, as described in the chapter.